

Sheet (5)

1. The **elevator system**, shown in the figure below, employs a platform to move objects up and down. The global objective is that when the UP button is pushed, the platform carries something to the UP position. And when the DOWN button is pushed, the platform carries something to the DOWN position.

The following required sequences of events for the elevator system are described as below:

1. When the SRART button is pushed, the platform is driven to the DOWN position.
2. When the STOP button is pushed, the platform is halted at whatever position it occupies at the time.
3. When the UP button is pushed, the platform, if it is not in DWON motion, is driven to the UP position.
4. When the DOWN button is pushed, the platform, if it is not in UP motion, is driven to the DOWN position.

Output elements:

M1: Motor to drive the platform up.

M2: Motor to drive the platform DOWN.

Input elements:

LS1: N.C. Limit switch to indicate UP position.

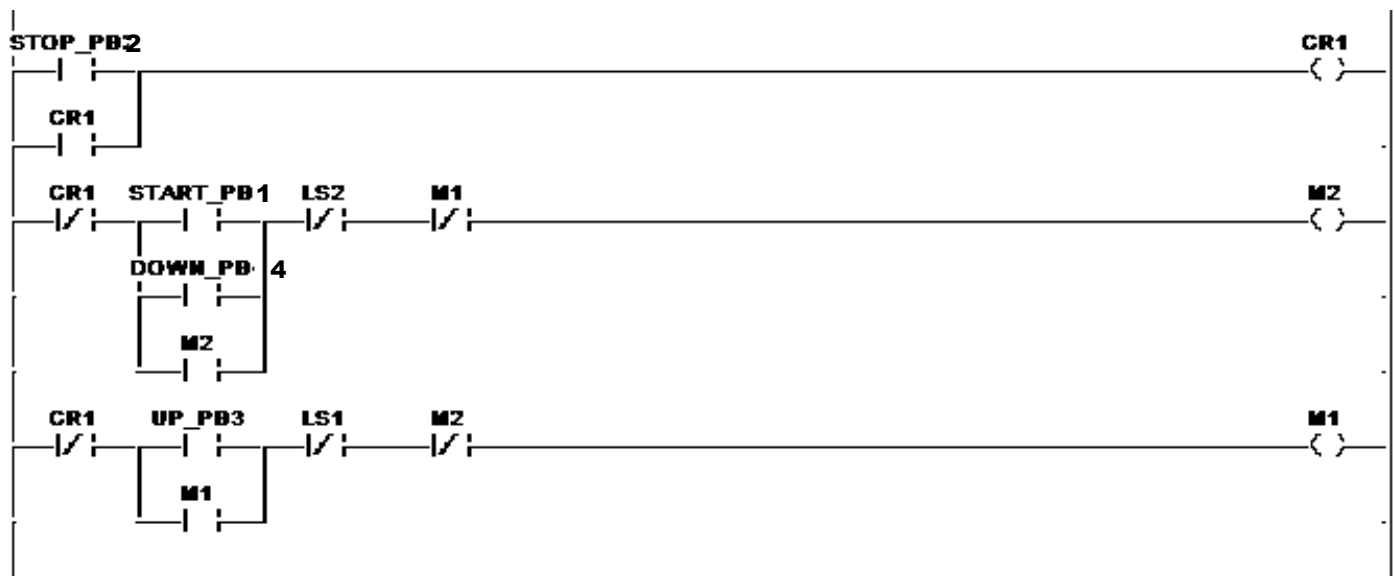
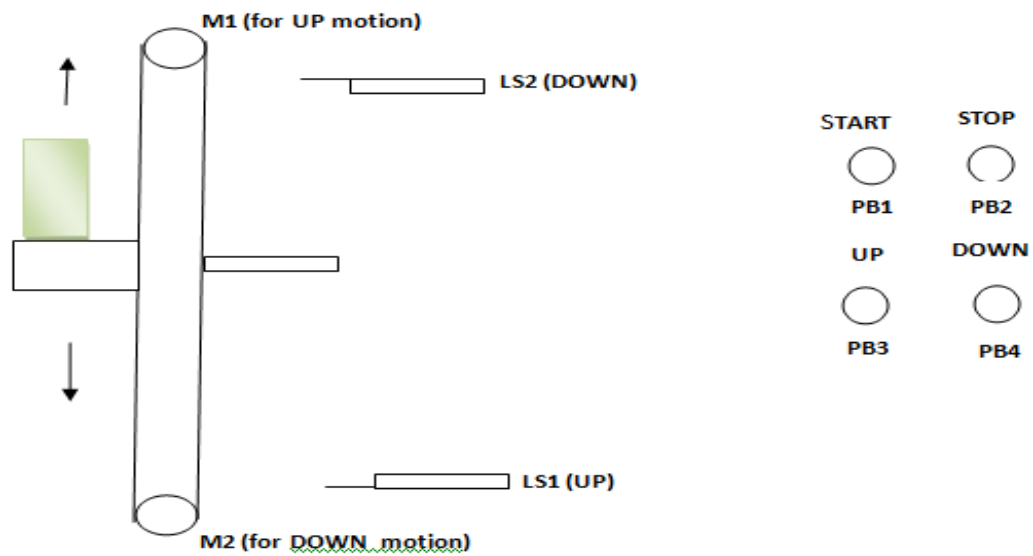
LS2: N.C. Limit switch to indicate DOWN position.

START: N.O. push-button for start.

STOP: N.O. push-button for stop.

UP: N.O. push-button for UP command.

DOWN: N.O. push-button for DOWN command.



2. Construct Boolean equations and draw Ladder Diagrams that implement the following events of an oven:

- 1) The heater will be ON when the on-switch is activated, the door is closed and the temperature is below the limit.

$$H = P \cdot D \cdot T$$



- 2) The fans will be placed ON when the heater is on, or when the temperature is above the limit and the door is closed.

$$F = H + T \cdot D$$



- 3) The light will be turned ON if the light switch is on or whenever the door is opened.

$$L = S + D$$



Output elements:

Heater: H

Fans: F

Light: L

Input elements:

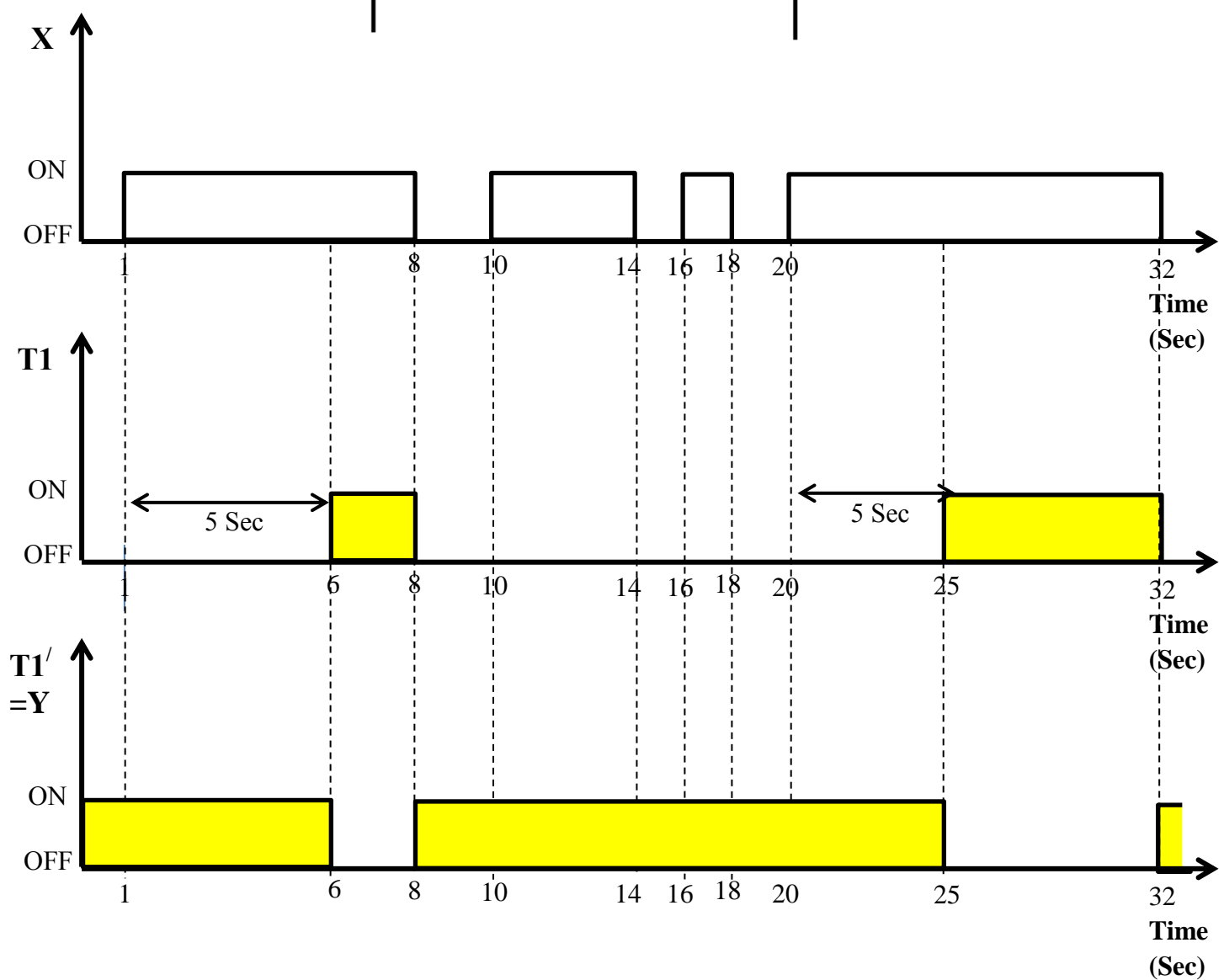
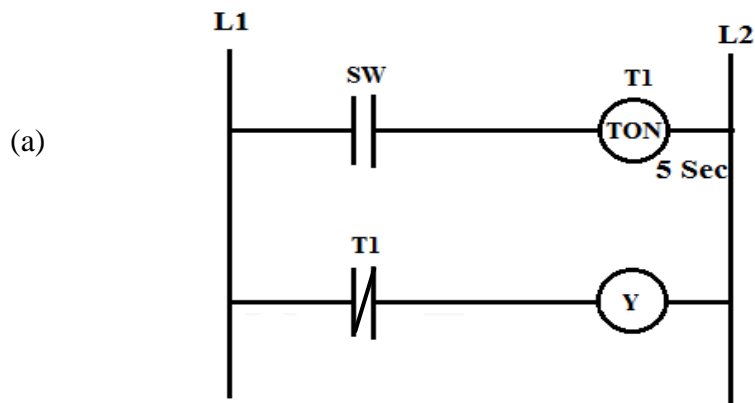
Door: D

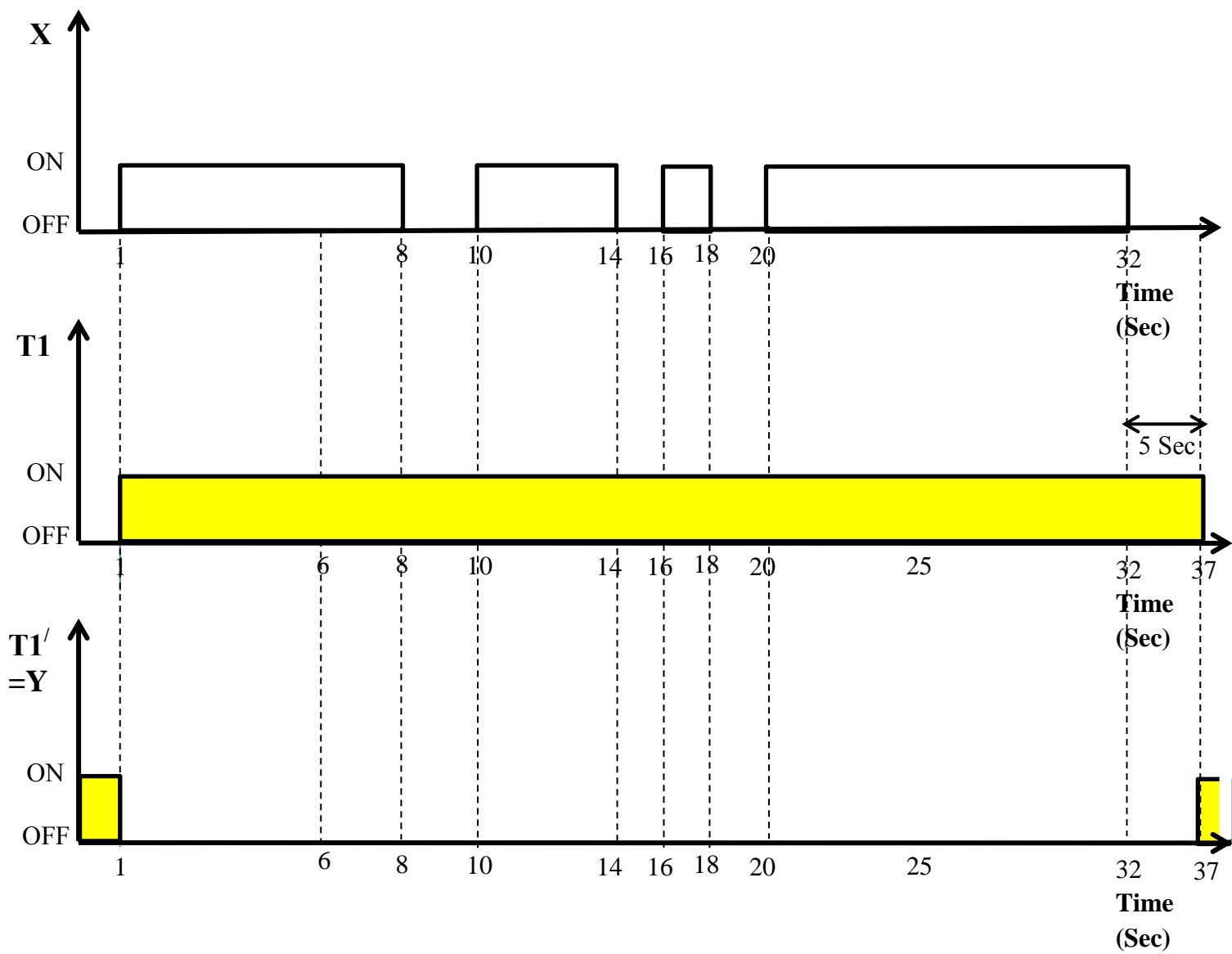
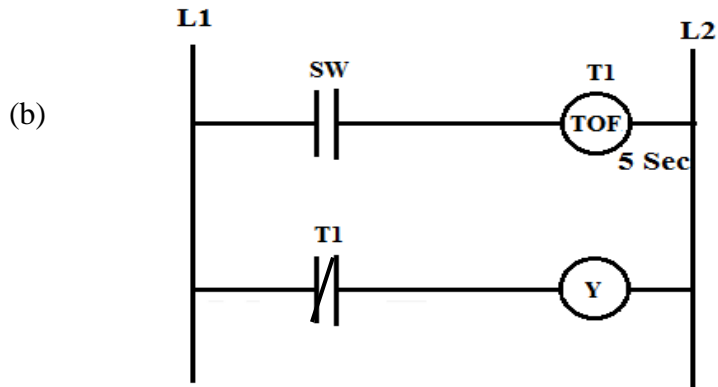
Temperature: T

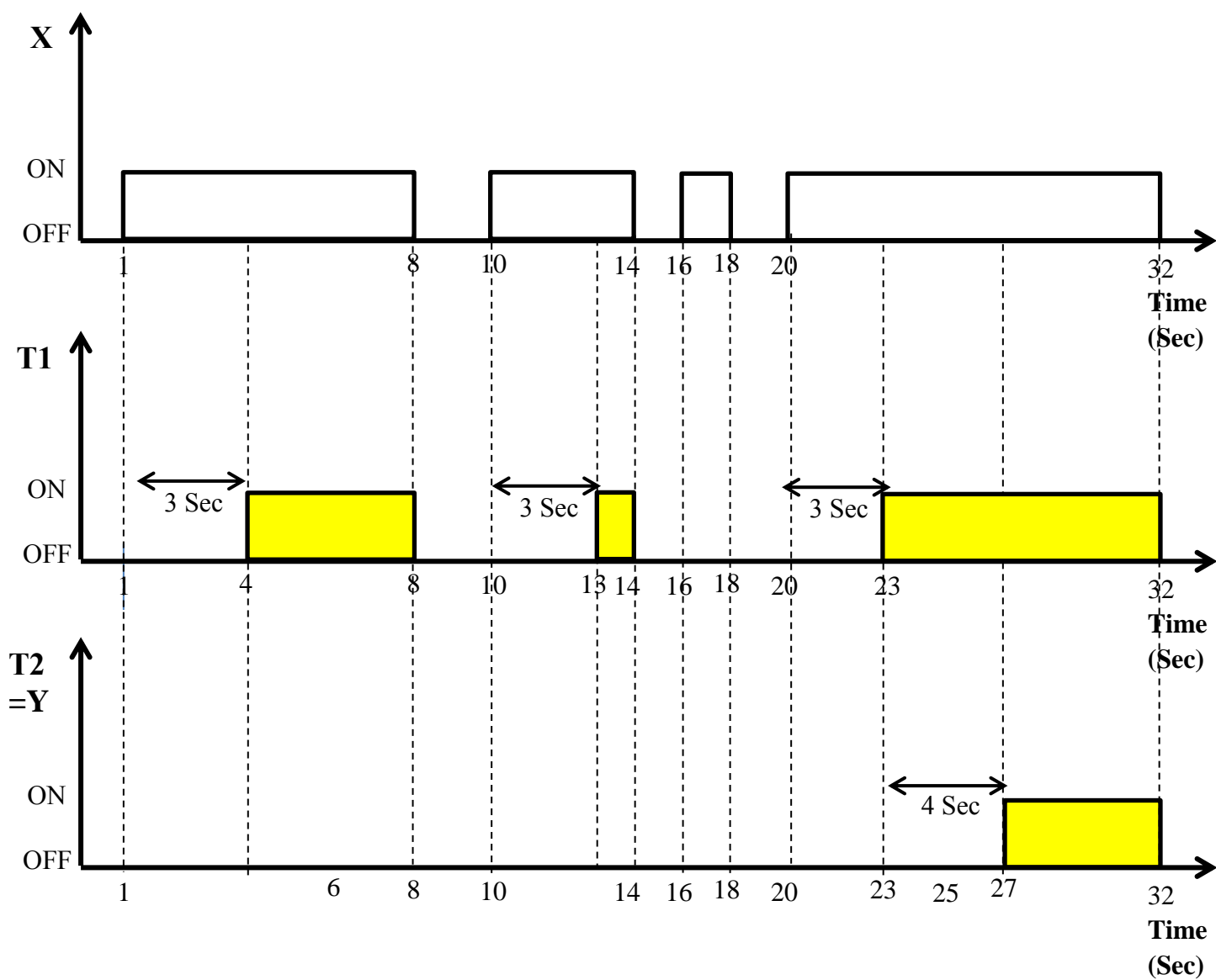
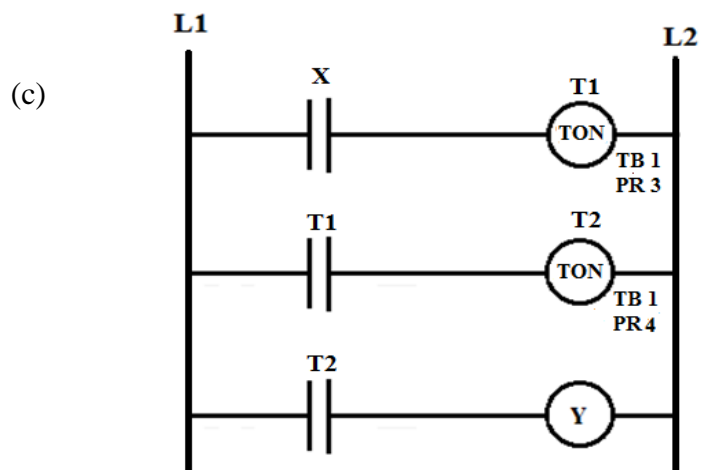
On-switch: P

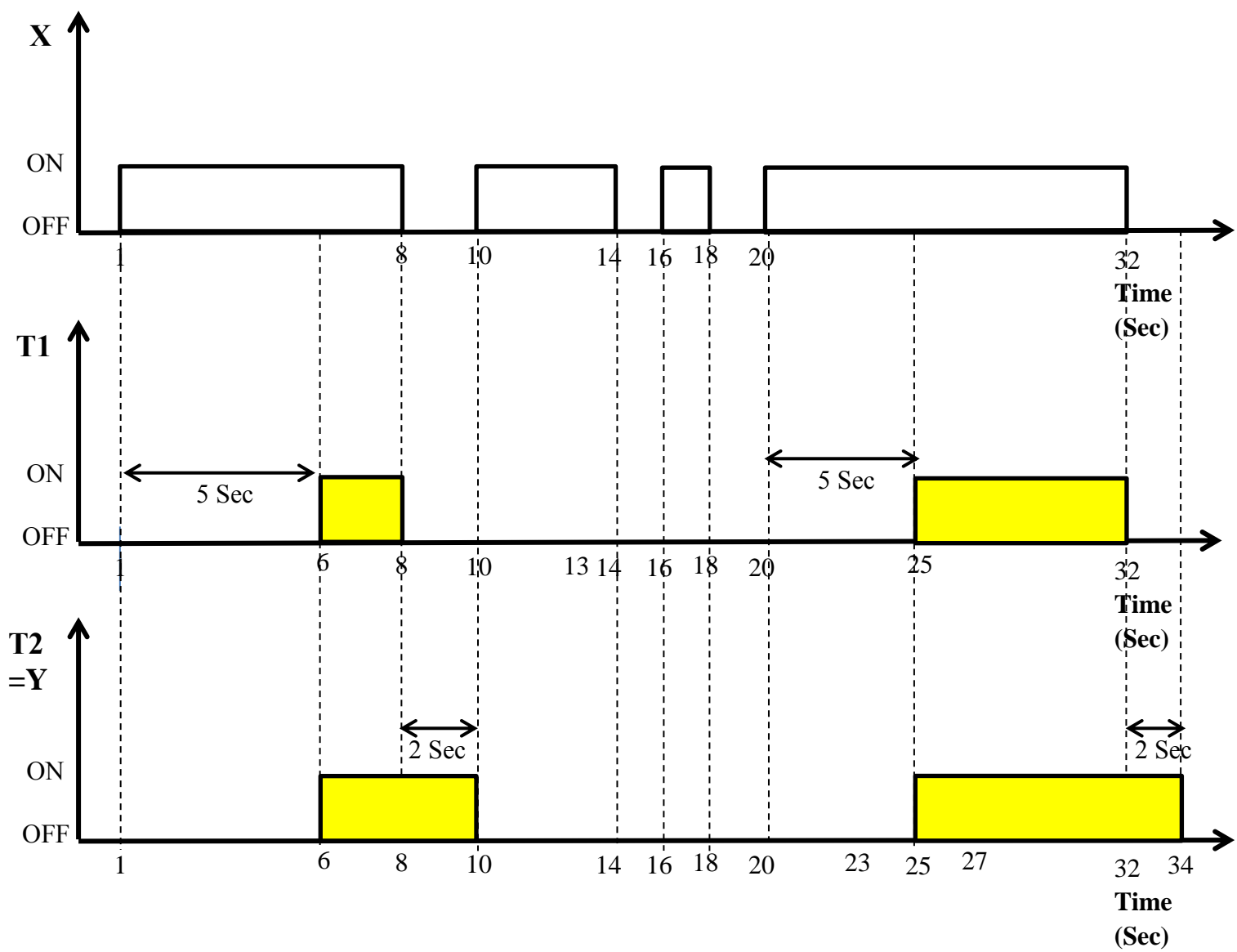
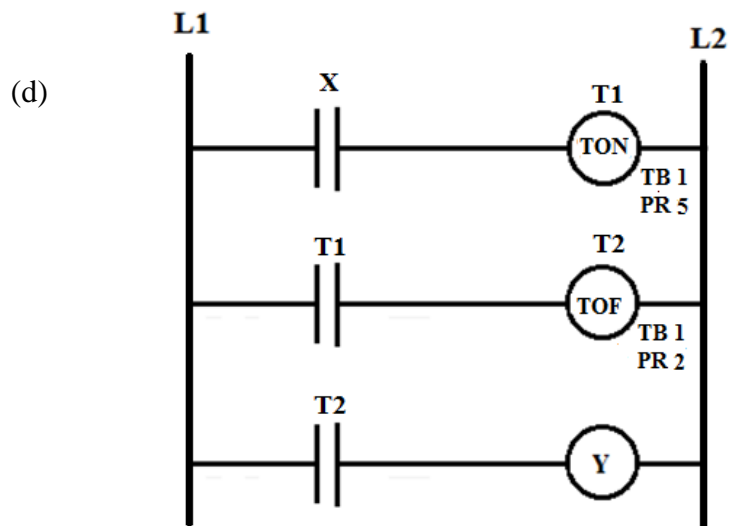
Light switch: S

3. For the following ladder diagrams, draw the timing diagram for the output Y. consider the following states of the input switch X:









4. For the following ladder diagram, draw the timing diagram for CR, T1, T2, T2, M1 and M2. consider the following states of the inputs:

